Antimicrobial stewardship

What's it all about?

McKenzie, Duncan; Rawlins, Matthew; Del Mar, Chris

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ARTICLE

Antimicrobial stewardship: what's it all about?

Duncan McKenzie
Pharmacy site manager
Royal Hobart Hospital

Matthew Rawlins
Infectious diseases pharmacist
Royal Perth Hospital

Chris Del Mar
Professor of Public Health
Bond University
Gold Coast
Queensland

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SUMMARY

The global problem of antibiotic resistance is threatening us. Since 2001, the proportion of methicillin-resistant *Staphylococcus aureus* (MRSA) infections in the community has doubled.

As one of the highest users of antibiotics in the developed world, Australia needs a more judicious approach to antibiotic use.

Antimicrobial stewardship programs, which aim to improve the appropriate use of antibiotics and reduce antibiotic resistance, have been shown to be effective in Australian hospitals.

Antimicrobial stewardship needs to be extended to the community where the greatest proportion of antibiotics are prescribed. Antibiotic restriction, education of prescribers and patients and prescribing feedback have already had some success.

Introduction

Much of the advancement in modern medicine has been made possible through access to safe and effective antibiotics. Although they remain the mainstay of treatment for infectious diseases, antibiotics are not effective against most acute respiratory infections, which are usually caused by viruses.

The pipeline of new antibiotics has almost completely dried up and use of the antibiotics we have will inevitably lead to resistance. Antibiotic-resistant pathogens found in Australia include:

- methicillin-resistant *Staphylococcus aureus* (MRSA)
- multi-resistant *Streptococcus pneumoniae*
- vancomycin-resistant enterococci
- multi-resistant *Escherichia coli* and other enterobacteriaceae.

Patients who acquire an antibiotic-resistant infection stay in hospital longer and have higher morbidity and mortality.[1] The World Health Organization refers to antibiotic resistance as one of the greatest threats to human health. The world is facing a global disaster unless action is taken now to preserve antibiotic effectiveness into the future.

The factors leading to bacterial resistance are complex and multifactorial. Along with infection control and surveillance, antimicrobial stewardship aims to reduce inappropriate use of antibiotics and improve patient outcomes.

Antimicrobial stewardship is a collective set of strategies to improve the appropriateness and minimise the adverse effects of antibiotic use including resistance, toxicity and costs. Stewardship is achieved by promoting the selection of the optimal antibiotic regimen, dose, duration and route of administration.

Antibiotic use and resistance in Australia

Australia is one of the highest users of antibiotics in the developed world, with around 22 million prescriptions written every year in primary care. The defined daily dose in Australia is nearly 23/1000 population/day compared with less than 15 for Denmark, the Netherlands and Sweden (Fig. 1).[2-5]

In hospitals

The federally-funded National Antimicrobial Utilisation Surveillance Program monitors antibiotic use in hospitals. It provides reports every two months on inpatient use, which enables analysis of trends and comparison of usage between hospitals.

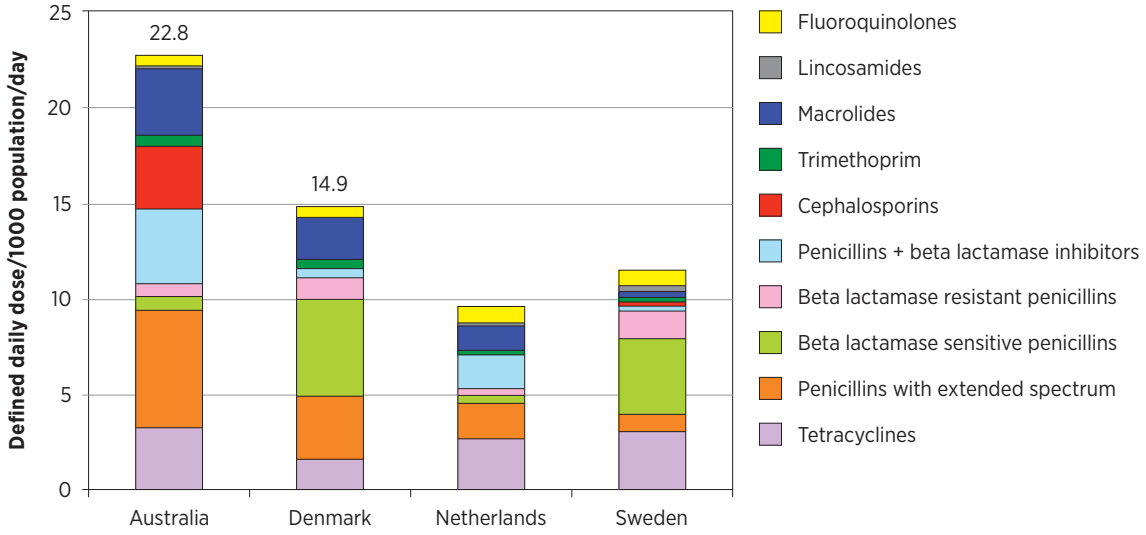
In the community

Estimating antibiotic use in the community is more difficult. It is based on a combination of Pharmaceutical Benefits Scheme and Repatriation Pharmaceutical Benefits Scheme reimbursement data, along with estimates of non-subsidised medicines obtained from surveying a representative sample of community pharmacies.

General practitioners prescribe the greatest proportion of antibiotics in Australia, mostly for acute respiratory tract infections. Antibiotics remain the most common class of medicine prescribed in general practice.

Resistant organisms are increasing in the community. These require treatment with antibiotics such as vancomycin, carbapenems and fluroquinolones, which

Fig. 1 **Comparison of Australian and European antibiotic use in the community in 2009** [2-5]



are often used when all other antibiotics have failed. For example between 2001 and 2010, the incidence of MRSA in the community doubled from 10 to 20% of all reported *S. aureus* infections.[6] In Tasmania, a recent increase in *Clostridium difficile* – an infection closely correlated with antibiotic use – was observed.[7] This was most likely linked to transmission and infection pathways in the community, not within hospitals, and was driven substantially by antibiotic use in the community.[8]

On a more positive note, when the selective pressure of antibiotics is removed, resistance can be reversed.[9] In the 12 months following antibiotic cessation in individual patients in the community, resistance fades towards zero.[10]

Antimicrobial stewardship in hospitals

Antimicrobial stewardship programs in hospitals have been shown to reduce inappropriate antibiotic use by 22–36%. Programs improve patient outcomes and reduce adverse consequences of antibiotic use, including antibiotic resistance, toxicity and unnecessary costs.[11]

Since 2011, antimicrobial stewardship has been included in the Australian Commission on Safety and Quality in Health Care's National Safety and Quality Health Service Standards for hospitals and is one of the compulsory criteria of the hospital accreditation process. The majority of hospitals in Australia, including smaller regional facilities, have or are currently in the process of implementing stewardship programs. Guidelines for implementing antimicrobial stewardship in Australian hospitals have been published.[12]

Programs must be adequately resourced and supported by hospital management. In large hospitals, antimicrobial stewardship is generally driven by a multidisciplinary team led by a clinician (usually an infectious diseases physician or clinical microbiologist) and a pharmacist, ideally with specialised training in infectious diseases. Teams work collaboratively within the hospital to implement the program (Box 1).

Several measures are used to assess the success of programs including antibiotic use, expenditure and antibiotic resistance. One proposed outcome indicator is the incidence of *C. difficile* infection.[8,12]

An antimicrobial stewardship program was launched at the Royal Hobart Hospital in May 2009. The following activities were included in the program:

- formulation of guidelines
- the use of a computer-based antibiotic restriction and approval program
- regular infectious diseases ward rounds on the intensive care and oncology units
- daily stewardship ward rounds providing feedback to antibiotic prescribers.

In the first 12 months, spending on antibiotics was reduced by 30% (approximately $300 000), along with a 20% reduction in prescribing of broad-spectrum antibiotics such as ceftriaxone and meropenem.

Antimicrobial stewardship in the community

Clearly antimicrobial stewardship needs to be extended to where the greatest use occurs.[14] Three principal strategies are already in place in the community. These are antibiotic restriction, prescriber and patient education and post-prescribing feedback (Box 2).

Box 1 Strategies for antimicrobial stewardship in hospitals

Five essential strategies:

- local prescribing guidelines based on Therapeutic Guidelines: Antibiotic[13] and modified according to local organisms and susceptibility patterns
- antibiotic restriction with approval systems for broad-spectrum drugs (by telephone or computer-based)
- giving feedback to the prescriber
- monitoring antibiotic prescribing data and external benchmarking
- reporting microbiological susceptibility results in line with the institution's restriction policy and treatment guidelines.

Additional activities adapted for local priorities and resources:

- staff education (on appropriate prescribing and antibiotic resistance)
- ward rounds (advice on treatment duration, changing empirical to directed therapy, appropriate dosing, and when to switch from intravenous to oral antibiotics)
- electronic prescribing (enhancing approval and decision support systems)
- provision of local antibiotic susceptibility data.

Box 2 Antibiotic stewardship strategies in the community

Restricting antibiotics via the Pharmaceutical Benefits Scheme

For example, restriction of fluoroquinolones means that their use is low (see Fig. 1). This may have contributed to the low Australian incidence of hyper-virulent *Clostridium difficile* strains associated with fluoroquinolone resistance.

Prescriber and patient education programs

Interventions combining doctor, patient and public education are the most successful at reducing inappropriate antibiotic prescribing for acute respiratory tract infections[15]

NPS MedicineWise:

- past programs have targeted overprescribing of antibiotics for acute respiratory tract infections and asymptomatic bacteriuria
- online learning modules on antibiotic prescribing
- individual academic detailing for general practitioners and pharmacists
- group discussions and case studies for the whole primary care team
- symptomatic management pads offer alternatives to antibiotics for acute respiratory tract infections

Prescribing feedback

NPS MedicineWise:

- prescribing rates sent to individual general practitioners allowing comparison with local and national averages
- tools provided for practices to perform clinical audits on antibiotic use

These strategies have had some success. General practitioner antibiotic prescribing for acute respiratory tract infections significantly decreased between 2000 and 2005. However, since 2005 there has been little change (Fig. 2).[16] This may be driven by consumer expectation – an NPS MedicineWise survey found that four in five Australians expected a prescription when they have an ear, nose, throat or chest infection.* Accordingly, in February 2012, NPS MedicineWise launched a five-year campaign against antibiotic resistance with a strong emphasis on community education.[17]

Proposed activities for the community

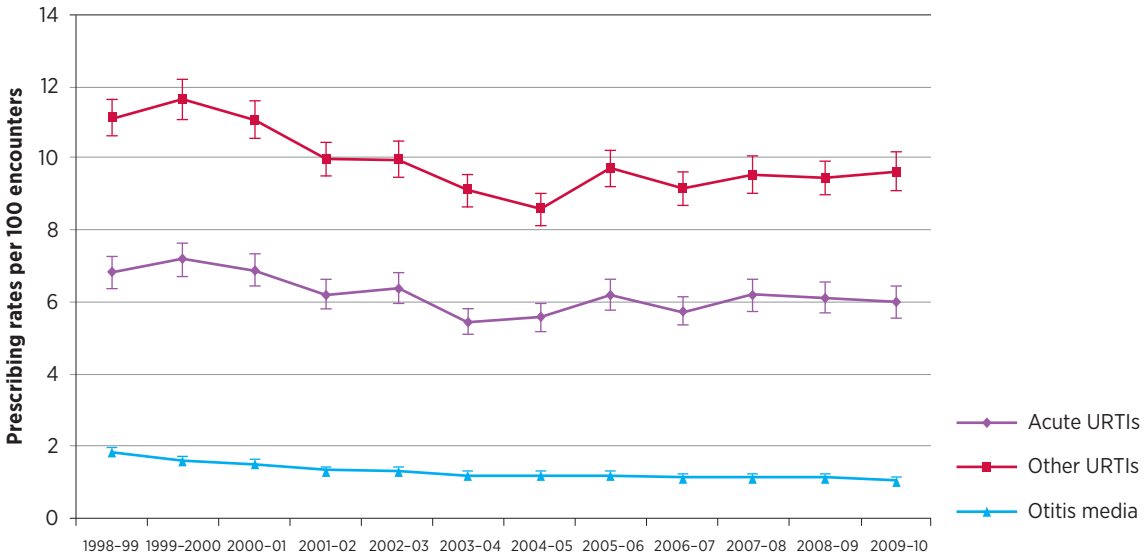
One approach could be to establish antimicrobial stewardship teams in the community. These could align with NPS MedicineWise to promote the quality use of antibiotics in the community. Teams could work out of Medicare Locals and residential aged-care facilities providing regular, ongoing NPS MedicineWise-endorsed education for prescribers and consumers, coordinated research, data collection and feedback (for example point prevalence surveys and clinical audits). In the future these teams might be guided by clinical standards for the quality use of antibiotics, set by the Australian Commission on Safety and Quality in Health Care's National Safety and Quality Health Service Standards for hospitals.

The teams could provide further focus on:

- delayed prescriptions – these are antibiotic prescriptions with instruction to the patient that they should only fill the antibiotic if they deteriorate.[18] This effectively reduces antibiotic use without causing anxiety for the patient or doctor[19]
- hand hygiene to reduce the spread of respiratory and other pathogens[20]
- alternatives to antibiotics – these include analgesics or decongestants for acute respiratory infections,[21] topical treatments for the pain associated with otitis media,[22] and corticosteroids[23,24] all of which need more evaluation
- emphasis on the adverse effects of antibiotics (such as thrush, diarrhoea, nausea)
- improved communication with patients – the assumption that patients expect antibiotics is often incorrect, and a better shared understanding of the objectives of managing acute respiratory tract infections may well lead to fewer antibiotic prescriptions.[21]

* www.nps.org.au/media-centre/media-releases/repository/1-in-5-australians-expect-antibiotics-for-coughs-or-colds-new-nps-campaign

Fig. 2 **Antibiotic prescribing for upper respiratory tract infections (URTIs) in Australia 1998–2010**



Adapted and reproduced with permission from the Australian Institute of Health and Welfare[16]

Conclusion

Antimicrobial stewardship in hospitals reduces the inappropriate use and consequences of antibiotics and improves patient outcomes. Aspects of stewardship are already in place in the community. Many of these are led by NPS MedicineWise. Adopting novel stewardship strategies in the community could provide a systematic approach to the growing threat of antibiotic resistance. <

Duncan McKenzie is chair of the Tasmanian Branch of the Society of Hospital Pharmacists of Australia. He is also a member of the Therapeutic Guidelines Respiratory Infections Expert Group, and executive committee member of the Committee of Specialist Practice (COSP) for Infectious Diseases, Society of Hospital Pharmacists of Australia.

Matthew Rawlins is an executive committee member of the Committee of Specialist Practice for Infectious Diseases, Society of Hospital Pharmacists of Australia.

Chris Del Mar is a member of Therapeutic Guidelines Writing Committees, coordinating editor of the Cochrane Acute Respiratory Infections Group, a member of the Remote Primary Health Care Manuals editorial committee, *and supported by NHMRC grant GNT1044904.*

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FURTHER READING

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Dental note

Antimicrobial stewardship

Christopher G Daly
Chair
Dental Therapeutics Committee
Australian Dental Association

Dentists should be aware that the prescription of antibiotics needs to be judicious, especially with growing concerns about antibiotic resistance. According to the Department of Health and Ageing, dentists account for about 3% of antibiotic prescribing. Dentists therefore contribute to antibiotic use within the community and play a role in the development of antimicrobial resistance. In Australia[1] and overseas[2] dentists have been found to over-prescribe antibiotics, particularly penicillins, as part of dental treatment. Antibiotics may be inappropriately prescribed for dental pain when operative dental treatment is the appropriate management.[2] An essential strategy to avoid inappropriate antibiotics or inappropriate dose and duration is use of prescribing guidelines such as Therapeutic Guidelines: Antibiotic.[3]

Dentists can contribute to community education about antibiotic resistance and can also reinforce the message of the NPS MedicineWise campaign[4] about using antibiotics only when indicated, by discussing these matters with their patients. However, the most important contribution that dentists can make in terms of judicious use of antibiotics is to follow prescribing guidelines. In Australia, these are presented in Therapeutic Guidelines: Oral and Dental.[5] These guidelines state in part: 'It must first be determined if an antimicrobial drug is needed. The majority of infections that present in the dental clinic require active dental treatment to remove the source of infection, and this is usually the most effective method of treating the problem.'

Specific guidelines[3,5] have been developed for antibiotic prophylaxis in the dental setting. The guidelines for antibiotic prophylaxis for the prevention of infective endocarditis were updated in Australia in 2008 and limit the number of conditions which require antibiotic cover.[3,5] Patients with mitral valve prolapse no longer require antibiotic cover for dental treatment. For patients with joint prostheses, the value of antibiotic prophylaxis has not been demonstrated. Prophylaxis is not recommended when the risks of adverse reactions outweigh its benefits.[3]

Antibiotics should not be prescribed unnecessarily as part of dental treatment. When they are indicated, dentists should follow the published recommendations for antibiotic selection, dose and duration.[5]

Conflict of interest: none relevant to this article

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